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ABSTRACT

Seven computer assignments for undergraduate economics students that concentrate on building a foundation for programming higher level mathematical calculations are described. The purpose of each assignment, the computer program for it, and the correct answers are provided. "Introduction to Text Editing" acquaints the student with some basic commands; "Introduction to the SAS Computer Language" teaches students commands for data set definition, data set entry, and data set procedures. The third exercise is a graph-plotting problem dealing with supply and demand. "Plotting a Consumption Function" requires the student to enter data on consumption and income, plot the consumption function, and calculate the marginal propensity to consume and the simple multiplier. In "Plotting a Phillips Curve," students enter data on unemployment and inflation and sketch in the Phillips Curve(s) that best fits. In the money supply exercise students use a program that plots the money supply, with lags, against inflation. The last exercise asks students about the relationship between deficits and interest rates over time. Four illustrative plots are included at the end of the seven exercises. Computer software designed for economics instruction for adults is also described and a five-page bibliography on the use of computers in economics education is given. (IS)

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USING COMPUTERS IN UNDERGRADUATE ECONOMICS COURSES

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Paper presented at the Southern Economics Association in 1983

SO 016 346

USING THE COMPUTER IN UNDERGRADUATE ECONOMICS COURSES

INTRODUCTION

The summer newspapers have heralded the arrival of the computer on the college campus. In the late sixties it was expected that the typical college freshman would grow long hair, be a political activist, purchase a knapsack, hiking boots, and books required for course work. In that order, in some cases! Today's typical college freshman wears short hair, is apolitical, and purchases a personal computer, and the books required for course work. At Carnegie Mellon, the New York Times reports, freshman are required to purchase a personal computer, and the college bookstore sells T-shirts with the IBM letters printed over the college initials and the logo reads: You will buy a computer.

Aside from "hacking", that is, unauthorized accessing of Federal Government and corporate computer systems, what do the students do with these computers? Or from the other side of the desk, how are our colleges using the computer in their courses? We don't know the answer to this question. However, we would like to share with you how we have been using the computer in our classes.

The normal college computer screen is not full of animated multi color images. Too bad. It would be a relatively easy task to generate an interest in economics rivaling that of the video arcade. Pac man and merger acquisition analysis are naturals. The basics are there. The lighted screen, manipulation of the cursor, and the instant feedback are surprisingly alluring to most students, and even some of us older faculty.

Our approach has been to use the computer like a hand calculator. Homework is assigned in the old fashion way, but the computer removes the tedium from the assignment. For example, instead of the students calculating what must seem to them endless lists of marginal utility, the students program the computer to make the calculations and print a neat chart of the results. Less time is spent on addition and subtraction, and is spent building the foundation for programing higher level mathematical calculations.

This paper consists of the description of several such homework assignments we have used in our classes. The object of the paper is to suggest ideas to noncomputer users, and elicit constructive comments.

The paper consists of the following sections:

I. Introduction to Text Editing: page 3
II. Introduction to SAS: page 4
III. Plotting Supply/Demand Graphs: pages 5-8
IV. Plotting a Consumption Function: pages 9-12
V. Plotting a Phillips Curve: pages 13-15
VI. Money Supply Exercise: page 16
VII. Plotting Deficits and Interest Rates over Time: pages 17-18

1. INTRODUCTION TO TEXT EDITING

The first order of business is to accuaint the stucert with some basic text eciting corrands. To this eno we give the stucent a file that contains a cuote with several typographic errors. The stucent is asked to correct the cuote using elementary text eciting commends. An example of such an exercise is given below.

A FINAL WCRD

"Thestudy ofeconomics does not seem torequire any specialized gifts of an unusually high order. Is it not, intellectually regarded, a very easy subject compared with the higher branches of philosophy or pure science? An easy subject, at which very few excel!
The paradox finds its explairation, perhaps, in that the masterecnomist must possess a rare combination of gifts. He must be mathematician, historian, statesman, philcsopher -- in some degree. He must understand symbols and speak in words. He must contemplate the particular in terms of the general, and touch abstract and concrete in the same flight of thought.

He must study the present in light of the past for the purpose of the future. No part of man's nature or his institutions must lie entirely outside his regard. He must be purposeful and disinterestec in a simultaneous mood; as aloof and incorruptible as an politician, yet sometimes as near the earth as a artist."
----J.M.Keynes "Essays in Biography," 1963

ORDERS:
Do each of the following in orcer, and one at a time.

1. Delete lines 1 to 7.
2. Copy line 2 to above line 3.
3. Insert a blank line below line 3.
4. Insert a blank line below line 9.
5. In line 5, insert spaces between the words that do not have spaces between them.
6. In line 11, change "explaination" to its correct spelling: "explanation".
7. In line 12, insert a hyphen: " - ", between "master" and "economist".
8. Move line 25 to just below line 1.
9. In line 24, change "poloticiar" to "artist".
10. In line 25, change "artist" to "politician".
11. Insert your name at the top of the file.
12. Name the file as: file name: first 7 characters of your last name, and the eight character: 1
    file type: MEMO
    file mode: A
14. Send the file to the machine: TC111INS
15. Keep a haracopy of the assignment for your files.

II. INTRODUCTION TO THE SAS COMPUTER LANGUAGE

The second order of business is to teach the student a few commands in a user friendly programming language. The following is an introduction to such a language.

An SAS program has three parts:

-- data set definition.
-- data set entry.
-- data set procedures.

A. Data Set Definition

This section gives the name of the data set, column location of the variables, and transformations on variables. An example of these statements is:

```
1)  DATA WORK1;
2)  INPUT V1;
3)  LABEL V1=PRICE;
4)  QD=100-(1.5*V1);
5)   LABEL QD=QUANTITY DEMANDED;
```

Statement #1 gives the data set a name, #2 gives the column location of the variables, #3 labells the variable, and #4 makes a transformation on the variable. (Statement #4 may be recognized as the ecuation for a demand curve.)

B. Data Set Entry

This section consists of the raw data. There are no restrictions on the number of blanks between the columns. An example is:

```
6)  CARDS;
7)        5
8)       10
9)  ;
```

Statement #6 indicates data is to follow, #7 and #8 are the data, #9 indicates the end of the data set.

C. Data Set Procedures

Many procedures are available. The examples in this paper make use of the PLOT and REGRESSION procedures. An example of the PLOT procedure is:

```
10)  PROC PLOT DATA=WORK1;
11)  PLOT V1*V2;
12)  TITLE01 A DEMAND CURVE;
```

Statements #10 and #11 request for a plot with the variable V1 on the vertical axis and the variable V2 on the horizontal axis, and #12 provides a title for the plot.

III. SUPPLY AND DEMAND EXERCISE

Consider the following equations:
QD = 100 - (1.5) (V1),
QS = -5 + (1.5) (V1),
where V1 = Price.

1. Construct a table of values for the implied supply and demand schedules for the prices 5, 10, ...,65.
2. Plot the demand and supply schedules in part 1, and determine the equilibrium price.
3. Suppose demand increases, and the new demand equation is:
QD1 = 150 - (1.5) (V1).
Plot this schedule in the graph for part 1, and determine the new equilibrium price.

A. Computer Program for the Above Exercise

```
//ES212FAA  JOB (5192,AAA3),'ES212FAA',CLASS=I,
// TIME=(1,0)                                                    X9X0
/*ROUTE PRINT UCONNVM.HARMON
//STEP1 EXEC SAS,LEVEL=SYS1
//SYSIN DD *
DATA W1;
INPUT V1 ;
LABEL V1=PRICE;
LABEL QD=QUANTITY DEMANDED;
LABEL QS=QUANTITY SUPPLIED;
LABEL QD1=QUANTITY DEMANDED FOR NEW DEMAND CURVE;
LABEL QS1=QUANTITY SUPPLIED FOR NEW SUPPLY CURVE;
*The initial demand and supply equations are:;
QD=100-(1.5*V1);
QS=-5+(1.5*V1);
*The equation for the situation where demand increases is:;
QD1=150-(1.5*V1);
*The equation for the situation where supply increases is:;
QS1=45+(1.5*V1);
PUT @10 V1 @20 QD @30 QS @40 QD1 @50 QS1;
CARDS;
5
10
15
20
25
30
35
40
45
50
55
60
65
;
PROC PRINT DATA=W1 LABEL;
```

```
VAR V1 QD QS;
TITLE01 TABLE NUMBER 1;
TITLE03 ORIGINAL DATA SET;
PROC PRINT DATA=V1 LABEL;
TITLE01 TABLE NUMBER 2;
TITLE03 DATA SET INCLUDING THE CHANGES IN DEMAND AND SUPPLY;
PROC PLOT DATA=V1;
PLOT V1*QD='D' V1*QS='S'/OVERLAY
VREF=0 20  40  60  80  100
HREF=0 20  40  60  80  100
VAXIS=0 to 100 by 5
HAXIS=0 to 100 by 5
VPOS=25
HPOS=45
;
TITLE01 FIGURE NUMBER 1;
TITLE03 PLOT OF ORIGINAL DEMAND AND SUPPLY CURVES;
PROC PLOT DATA=V1;
PLOT V1*QD='D' V1*QS='S' V1*QD1='*'/OVERLAY
VREF=0 20  40  60  80  100
HREF=0 20  40  60  80  100 120 140 160
VAXIS=0 to 100 by 5
HAXIS=0 to 160 by 5
VPOS=25
HPOS=45
;
TITLE01 FIGURE NUMBER 2;
TITLE03 PLOT OF THE INCREASE IN THE DEMAND CURVE.;
TITLE04 AND THE ORIGINAL SUPPLY AND DEMAND CURVES;
*The new demand curve, following an increase in demand,
 is represented by the symbol "*";
PROC PLOT DATA=V1;
PLOT V1*QD='D' V1*QS='S' V1*QD1='*' V1*QS1='#'/OVERLAY
VREF=0 20  40  60  80  100
HREF=0 20  40  60  80  100 120 140 160
VAXIS=0 to 100 by 5
HAXIS=0 to 160 by 5
VPOS=25
HPOS=45
;
TITLE01 FIGURE NUMBER 3;
TITLE03 PLOT OF THE INCREASE IN THE DEMAND AND SUPPLY CURVES.;
TITLE04 AND THE ORIGINAL SUPPLY AND DEMAND CURVES;
*The new supply curve, following an increase in supply,
 is represented by the symbol "#";
//
/*
```

B. Answers to the Above Exercise

TABLE NUMBER 1

ORIGINAL DATA SET

OBS	PRICE	QUANTITY DEMANDED	QUANTITY SUPPLIED
1	5	92.5	2.5
2	10	85.0	10.0
3	15	77.5	17.5
4	20	70.0	25.0
5	25	62.5	32.5
6	30	55.0	40.0
7	35	47.5	47.5
8	40	40.0	55.0
9	45	32.5	62.5
10	50	25.0	70.0
11	55	17.5	77.5
12	60	10.0	85.0
13	65	2.5	92.5

TABLE NUMBER 2

DATA SET INCLUDING THE CHANGES IN DEMAND AND SUPPLY

OBS	PRICE	QUANTITY DEMANDED	QUANTITY SUPPLIED	QUANTITY DEMANDED FOR NEW DEMAND CURVE	QUANTITY SUPPLIED FOR NEW SUPPLY CURVE
1	5	92.5	2.5	142.5	52.5
2	10	85.0	10.0	135.0	60.0
3	15	77.5	17.5	127.5	67.5
4	20	70.0	25.0	120.0	75.0
5	25	62.5	32.5	112.5	82.5
6	30	55.0	40.0	105.0	90.0
7	35	47.5	47.5	97.5	97.5
8	40	40.0	55.0	90.0	105.0
9	45	32.5	62.5	82.5	112.5
10	50	25.0	70.0	75.0	120.0
11	55	17.5	77.5	67.5	127.5
12	60	10.0	85.0	60.0	135.0
13	65	2.5	92.5	52.5	142.5

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FIGURE NUMBER 1

PLOT OF ORIGINAL DEMAND AND SUPPLY CURVES

SEE HANDOUT FIGURE ONE

FIGURE NUMBER 2

PLOT OF ORIGINAL DEMAND AND SUPPLY CURVES
AND THE INCREASE IN DEMAND

SEE HANDOUT FIGURE TWO

FIGURE NUMBER 3

PLOT OF THE INCREASE IN THE DEMAND AND SUPPLY CURVES,
AND THE ORIGINAL SUPPLY AND DEMAND CURVES
QUANTITY DEMANDED

SEE HANDOUT FIGURE THREE

IV. PLOTTING A CONSUMPTION FUNCTION

In this assignment the student is asked to type in data on consumption and income (1960-1982) from the Economic Report of the President, plot the consumption function, and calculate the marginal propensity to consume and the simple multiplier.

A. Computer Program for the above Exercise

```
//ES111FEA  JOB (9244,AEA3),'ES111FEA',CLASS=I,
// TIME=(1,0)                                          BCH4
/*ROUTE PRINT UCONNMVS.REMOTE01
//STEP1 EXEC SAS,LEVEL=SYS1
//SYSIN DD *
DATA A1;
INPUT V1 V2 V3 ;
LABEL V1=TIME;
LABEL V2=PERSONAL CONSUMPTION;
LABEL V3=DISPOSABLE PERSONAL INCOME;
LABEL V4=CHANGE IN V2 (PC);
LABEL V5=CHANGE IN V3 (DPI);
V4=V2-LAG1(V2);
V5=V3-LAG1(V3);
PUT @10 V1 @20 V2 @30 V3;
* Insert data below the CARDS statement in the following order;
*Time (space) Personal Consumption (space) Disposable Personal Income;
CARDS;
1960  324.5 352.0
1982  1972.8 2172.5
;
* The line directly above contains only a semi colon;
* Do not erase disturb this line. Do not insert data below it;
* The procedure below prints all the observations in the data set;
PROC PRINT DATA=A1 LABEL;
TITLE01 TABLE NUMBER 1;
```

```
TITLE02 OBSERVATIONS ON PERSONAL CONSUMPTION AND DISPOSABLE PERSONAL
        INCOME, 1960-1982, ANNUALLY IN BILLIONS OF DOLLARS;
* The procedure below plots a consumption function using the above data;
PROC PLOT DATA=W1;
PLOT V2*V3='*'/
VREF=500 1000 1500 2000
HREF=500 1000 1500 2000 2500
VAXIS=300 TO 2200 BY 100
HAXIS=300 TO 2200 BY 100
VPOS=45
HPOS=65
;
TITLE01 FIGURE NUMBER ONE;
TITLE02 PLOT OF PERSONAL CONSUMPTION V. DISPOSABLE PERSONAL INCOME;
* Your assignment ---;
* 1) Modify the Job Card by inserting your machine letter, ;
*    your account letter, and your original password one;
* 2) Enter data into the program.  A xerox copy of data will be provided;
* 3) Draw a linear line that best fits the data plotted in;
*    Figure Number One;
* 4) Estimate the slope of this line, show your work;
* 5) Calculate the MPC and the multiplier for this consumption function;
*    and write this on the lower right hand corner of Figure Number One.;
* 6) Write your name at the top right hand corner of Figure Number One;
* 7) Separate Figure Number One from the rest of the print out and;
* 8) turn this in to the instructor on Wednesday, October   1983.;
//
/*
```

B. Answers to the Above Exercise

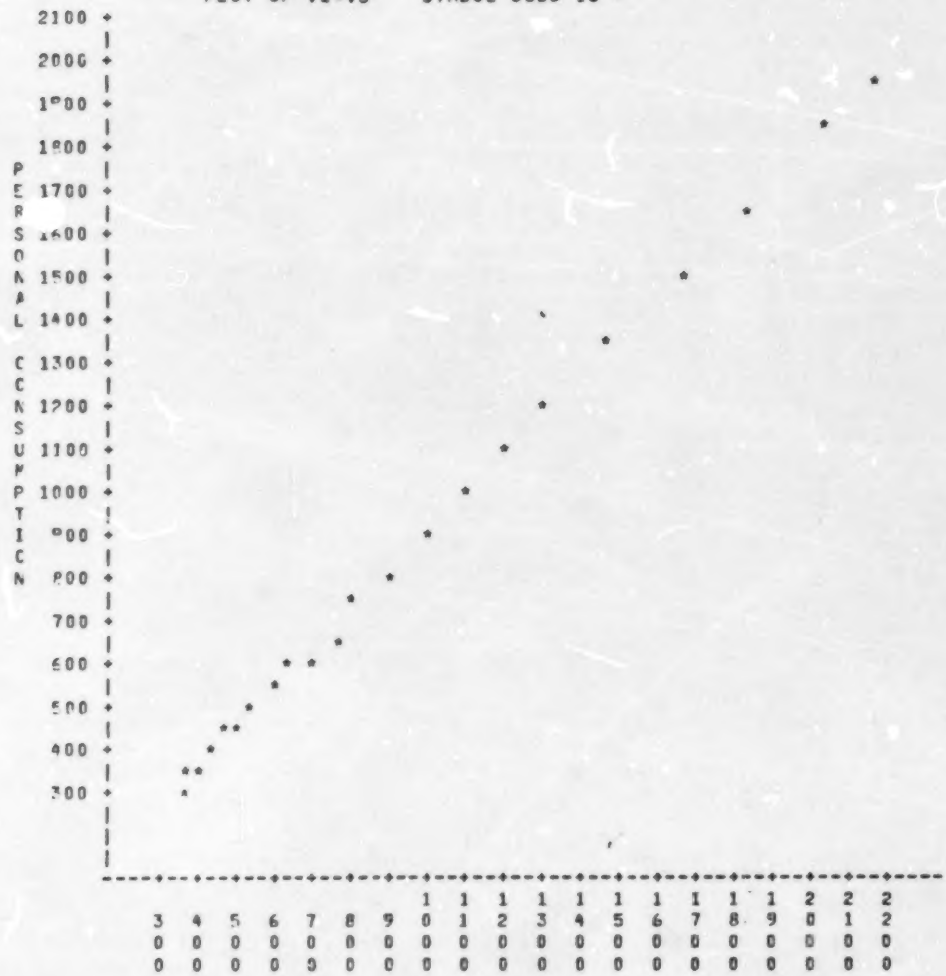
TABLE NUMBER 1 19:01 SUNDAY, OCTOBER 16, 1983 1

OBSERVATIONS ON PERSONAL CONSUMPTION AND DISPOSABLE PERSONAL INCOME, 1960-1982, ANNUALLY IN BILLIONS OF DOLLARS

OBS	TIME	PERSONAL CONSUMPTION	DISPOSABLE PERSONAL INCOME
1	1960	324.9	352.0
2	1961	335.0	365.8
3	1962	355.2	386.8
4	1963	378.6	40..9
5	1964	400.5	440.6
6	1965	430.4	475.8
7	1966	465.1	513.7
8	1967	490.3	547.9
9	1968	536.9	593.4
10	1969	581.8	638.9
11	1970	621.7	695.3
12	1971	672.2	751.8
13	1972	737.1	810.3
14	1973	812.0	914.5
15	1974	888.1	958.3
16	1975	976.4	1096.1
17	1976	1084.3	1194.4
18	1977	1204.4	1314.0
19	1978	1346.5	1474.0
20	1979	1507.2	1650.2
21	1980	1667.2	1824.1
22	1981	1843.2	2029.1
23	1982	1972.0	2172.5

FIGURE NUMBER ONE 19:01 SUNDAY, OCTOBER 16, 1983

PLOT OF PERSONAL CONSUMPTION V. DISPOSABLE PERSONAL INCOME



V. PLOTTING A PHILLIPS CURVE

In this assignment the student is asked to type in data on unemployment and inflation (1960-1982) from the Economic Report of the President, and to "sketch" in the phillips curve(s) that best fit the points. The sketching is done at the computer terminal and affords an elementary introduction to computer graphics.

A. Computer Program for the above exercise

```
//ES212FAA  JOB (5192,AAA3),'ES212FAA',CLASS=D,
// TIME=(1,0)                                                    59X0
/*ROUTE PRINT UCONNVM.ES212FAA
//STEP1 EXEC SAS,LEVEL=SYS1
//SYSIN DD *
DATA W1;
INPUT V1 V2 V3;
LABEL V1=INFLATION;
LABEL V2=UNEMPLOYMENT;
LABEL V3=TIME;
PUT @1 V1 @20 V2 @30 V3;
* Insert data below the CARDS statement in the following order;
* Inflation rate (space) Unemployment rate (space) Time (space);
CARDS;
1.6  5.0 1960
6.1  5.7  1982
;
PROC PRINT DATA=W1;
* The above Proc prints the data set;
* The below Proc plots the relation between inflation and unemployment;
PROC PLOT DATA=W1;
PLOT V1*V2/
VREF=0 1 2 3 4 5 6
HREF=0 1 2 3 4 5 6
VAXIS=0 to 6 by .5
haxis=0 to 6 by .5
VPOS=60
HPOS=60
;
* Your assignment--;
*  1) Enter data into the program. (Xerox of data set provided);
*  2) Have the plot routed to your terminal;
*  3) At your terminal select an approiate symbol, and;
*     draw a phillips curve that fits the scatter diagram;
//
/*
```

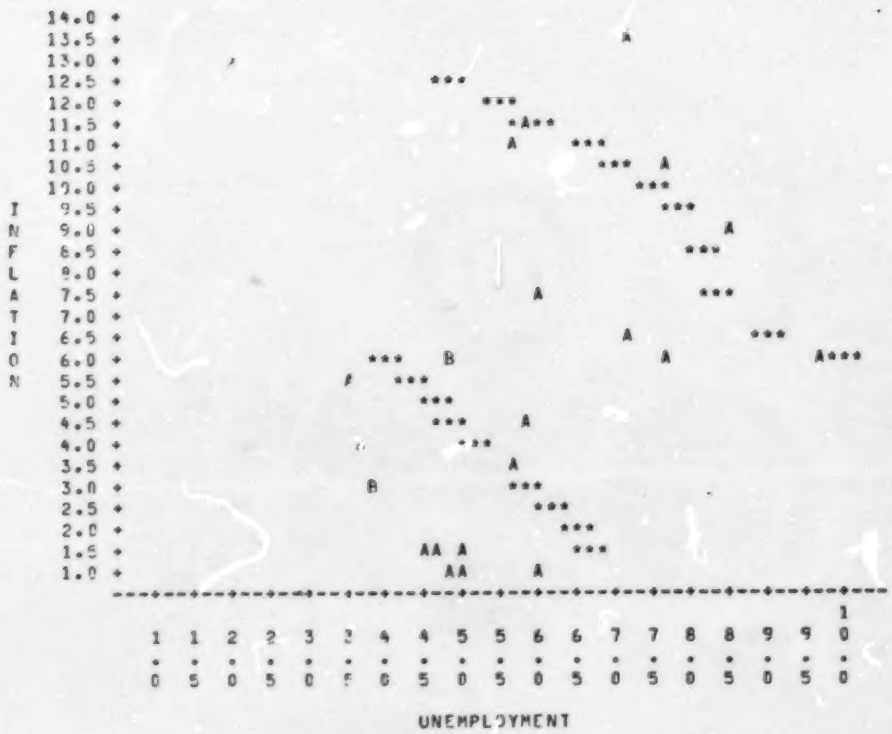
B. Answers to the above Exercise

OBS	V1	V2	V3
1	1.6	5.0	1960
2	1.0	6.0	1961
3	1.1	4.[illegible]	1962
4	1.2	5.[illegible]	1963
5	1.3	4.6	1964
6	1.7	4.5	1965
7	2.9	3.8	1966
8	2.5	3.8	1967
9	4.2	3.6	1968
10	5.4	3.5	1969
11	5.9	4.9	1970
12	4.3	5.9	1971
13	3.3	5.6	1972
14	6.2	4.9	1973
15	11.0	5.6	1974
16	9.1	8.5	1975
17	5.8	7.7	1976
18	6.5	7.1	1977
19	7.7	6.1	1978
20	11.3	5.8	1979
21	13.5	[illegible].1	1980
22	10.4	7.6	1981
23	6.1	9.7	1982

FIGURE NUMBER 1
THE PHILLIPS CURVE

22:52 SUNDAY, OCTOBER 16, 1983

PLOT OF V1*V2 LEGEND: A = 1 OBS, B = 2 OBS, ETC.



VI. MONEY SUPPLY EXERCISE

In this exercise the student types in data on inflation and the money supply.

The program plots the money supply, with three separate lags, against inflation. The student is requested to color code the plots and determine which money supply lag is most closely associated with inflation.

A. Computer Program for above Exercise.

```
//ES212FAA  JOB (5192,0013),'HARMON',CLASS=I,
// TIME=(1,0)                                                    V8WZ
/*ROUTE PRINT UCONNMVS.REMOTE01
//STEP1 EXEC SAS,LEVEL=SYS1
//SYSIN DD *
DATA W1;
INPUT V1 V2 V3 V4 V6 V7;
LABEL V1=INFLATION;
LABEL V2=TOTAL UNEMPLOYMENT RATE;
LABEL V3=TIME;
LABEL V4=MONEY SUPPLY;
LABEL V5=% CHANGE IN V4 (M SUPPLY);
LABEL V8=MONEY SUPPLY % LAG 1 PERIOD;
LABEL V9=MONEY SUPPLY % LAG 2 PERIOD;
LABEL V10=MONEY SUPPLY % LAG 3 PERIOD;
V5=((V4-LAG1(V4))/LAG1(V4))*100;
V8=LAG1(V5);
V9=LAG2(V5);
V10=LAG3(V5);
PUT @1 V1 @20 V2 @30 V3 @40 V4 ;
CARDS;
1.6  5.0 1960 312.3 4.8 5.3
6.1  9.7  1982 1999.1 8.8 8.3
;
PROC PRINT DATA=W1 LABEL;
PROC PLOT DATA=W1;
PLOT V5*V3='0' V8*V3='1' V9*V3='2' V1*V3='X' V10*V3='*'/ OVERLAY
VREF=2 4 6 8 10 12 14 16 18 20 22 24
HREF=1960 1965 1970 1975 1980
VAXIS=1 to 24 by .5
HAXIS=1960 to 1982 by 1
VPOS=25
HPOS=130
;
TITLE01 FIGURE NUMBER 2;
TITLE02 PLOT MONEY SUPPLY LAGGED 0,1,2 AND 3 PERIODS. INFLATION V. TIME;
* Your assignment--;
* On your hardcopy color code the money supply plots and determine;
* which lag has the best fit with inflation.;
//
/*
```

B. Answers to above exercise.

Plot was not prepared in time for conference.

PLOTTING DEFICITS AND INTEREST RATES OVER TIME

The following is an exercise which plots government deficits and interest rates over time and asks the student several questions about the relation between these two economic variables.

A. Computer Program

```
//ES111FEY  JOB (5244,AEY3),'ES111FEY',CLASS=H,                    JPTO
// TIME=(0,20),MSGLEVEL=(0,0)
/*ROUTE PRINT UCOMMMVS.REMOTE01
//STEP1 EXEC SAS,LEVEL=SYS1
//SYSIN DD *
DATA W1;
INPUT V1 V2 V3 ;
LABEL V1=TIME;
LABEL V2=FEDERAL BUDGET DEFICIT, IN $BILLIONS;
LABEL V3=YIELD ON 10 YR. US TREASURY SECURITIES;
PUT $10 V1 $20 V2 $30 V3;
* Insert data below the CARDS statement in the following order;
*Time (space) Federal Budget Deficit (space) Yield on US Treas. Sec.;
CARDS;
1960     .31   4.12
1961    -3.4   3.88
1962    -7.1   3.95
1963    -4.8   4.00
1964    -5.9   4.19
1965    -1.6   4.28
1966    -3.8   4.52
1967    -8.7   5.07
1968   -25.2   5.65
1969     3.2   6.67
1970    -2.8   7.35
1971   -23.0   6.16
1972   -23.4   6.21
1973   -14.8   6.64
1974    -4.7   7.56
1975   -45.2   7.99
1976   -66.4   7.61
1977   -44.9   7.42
1978   -48.8   8.41
1979   -27.7   9.44
1980   -59.6  11.46
1981   -57.9  13.91
1982 -111.6  13.00
;
* The line directly above contains only a semi colon;
* Do not erase disturb this line. Do not insert data below it;
* ;
* ;
* The procedure below prints all the observations in the data set;
* ;
PROC PRINT DATA=W1 LABEL;
TITLE01 TABLE NUMBER 1;
TITLE02 OBSERVATIONS ON THE FEDERAL BUDGET DEFICIT (in $bil.) and
        YIELDS ON 10 YR U.S.TREASURY SECURITIES (in %);
```

```
* ;
*The next step converts V3 to decimal form and V2 to trillions;
* ;
DATA W2; SET W1;
V3=V3*(.01);
V2=V2*(.001);
* ;
* The procedure below plots the values of 10 yr. US Treasury yields,;
* and the Federal Budget Deficit on the vertical axis and time on;
* the horizontal axis.;
* ;
PROC PLOT DATA=W2;
PLOT V3*V1='%' V2*V1='$'/OVERLAY
VREF=-.10 -.05 0.0 .05 .10
HREF=1965 1970 1975 1980
VAXIS=-.120 TO .150 BY .01
HAXIS=1960 TO 1982 BY 1
VPOS=45
HPOS=70
;
TITLE01 FIGURE NUMBER ONE;
TITLE02 PLOT OF 10 Yr. TREASURY YIELDS AND FEDERAL BUDGET DEFICITS OVER
TIME;
TITLE03 TREASURY YIELDS are expressed in decimal form and identified by
the symbol:'%';
TITLE04 FEDERAL BUDGET DEFICITS are expressed in trillions and
identified by the symbol:' $';
* Your assignment ---;
* 1) Modify the Job Card by inserting your machine letter, ;
*    your account letter, and your original password one;
* 2) Enter data into the program.  A xerox copy of data will be provided;
* 3) In Figure Number One connect the dots for each plot.  Use a
     different color for each plot.;
* 4) Study Figure Number One and decide whether or not burget deficits
     influence interest rates.;
* 5) In one typewritten page or less, explain the decision reached in
     step 4, and give an economic explanation the relation between
     budget deficits and interest rates;
* 6) Write your name at the top right hand corner of Figure Number One;
* 7) Separate Figure Number One from the rest of the print out ;
* 8) Staple your response to step five to the response to step 7 and
     turn this in to the instructor on MONDAY, DECEMBER 12, 1983.;
//
/*
```

B. Answers to the Exercise

See Handout Figure Number Four

FIGURE NUMBER 1 22:23

PLOT OF ORIGINAL DEMAND AND SUPPLY CURVES

PLOT OF V1*GD SYMBOL USED IS D
PLOT OF V1*GS SYMBOL USED IS S

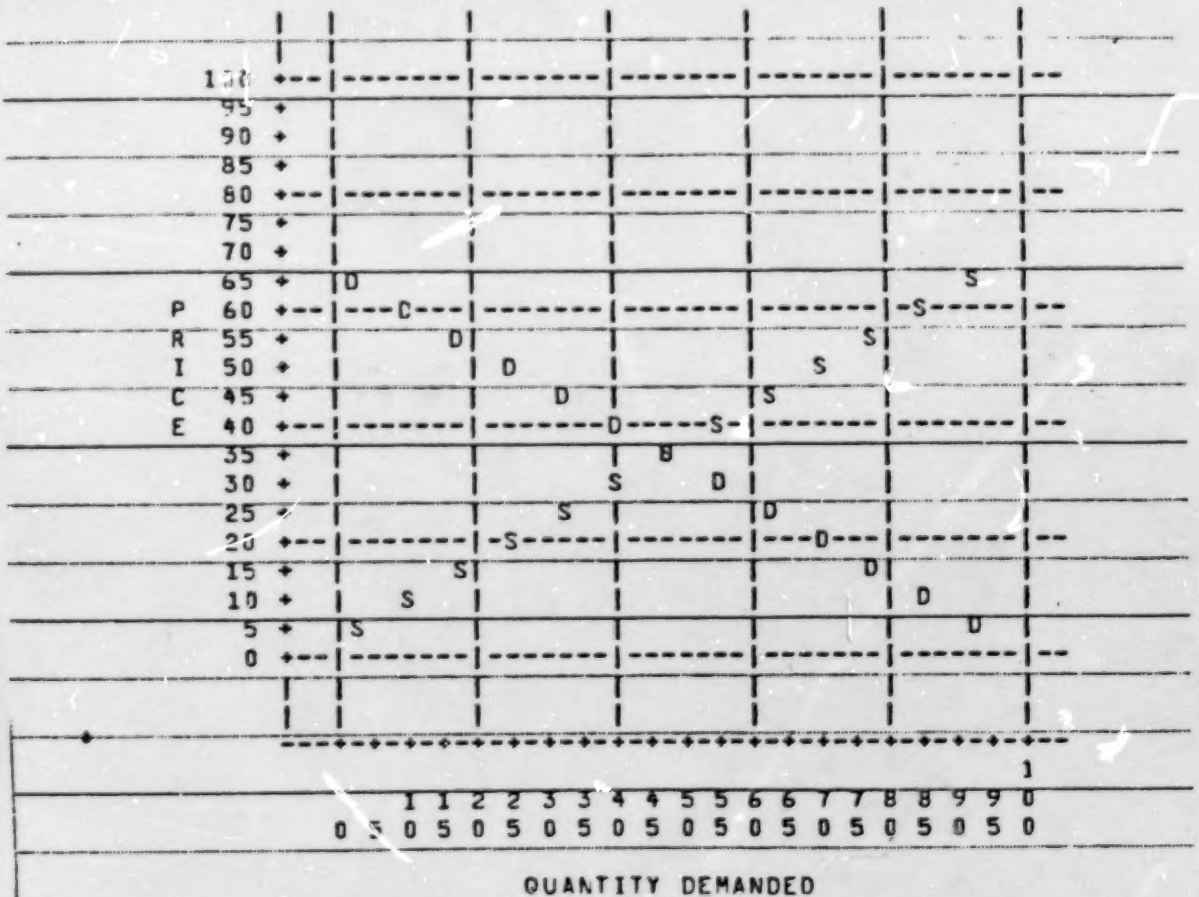
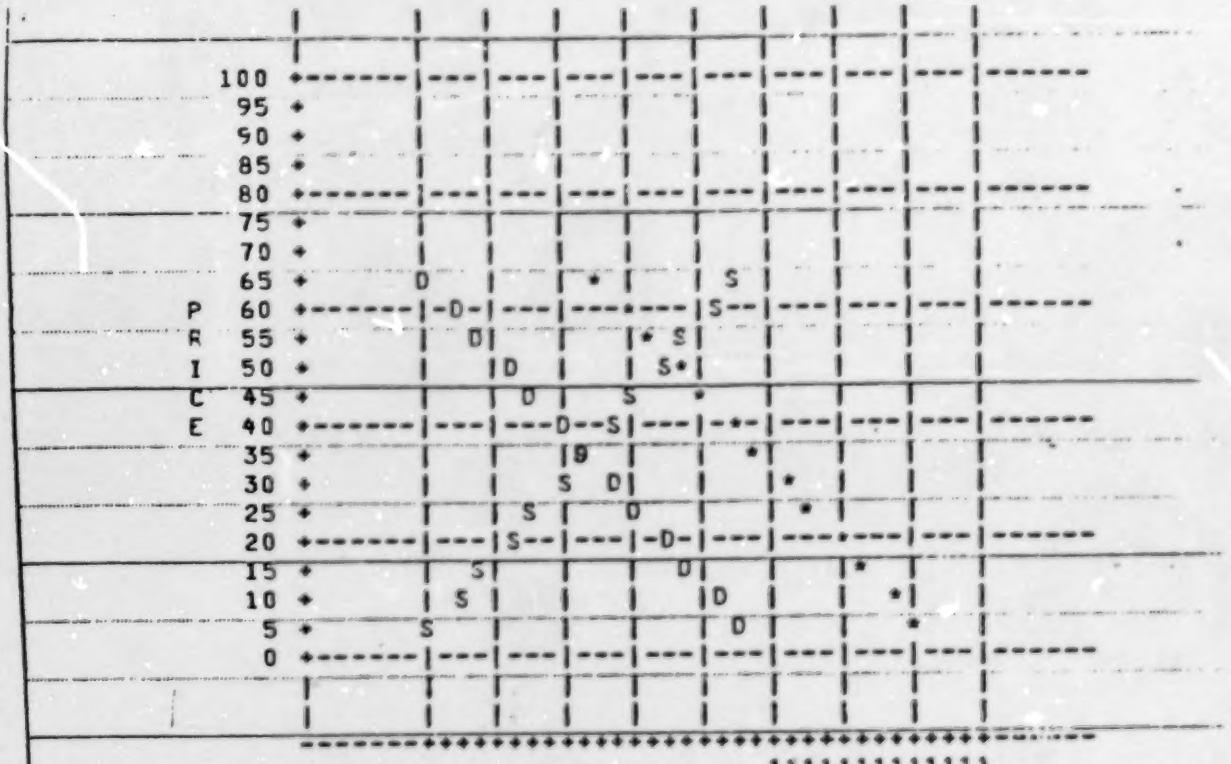


FIGURE NUMBER 2 22:23

PLOT OF THE INCREASE IN THE DEMAND CURVE,
AND THE ORIGINAL SUPPLY AND DEMAND CURVES

PLOT OF V1•GD SYMBOL USED IS D
PLOT OF V1•OS SYMBOL USED IS S
PLOT OF V1•OD1 SYMBOL USED IS *



QUANTITY DEMANDED

FIGURE NUMBER 3 22:23 21

PLOT OF THE INCREASE IN THE DEMAND AND SUPPLY CURVES, AND THE ORIGINAL SUPPLY AND DEMAND CURVES

PLOT OF V1*GD SYMBOL USED IS D
PLOT OF V1*GS SYMBOL USED IS S
PLOT OF V1*GD1 SYMBOL USED IS *
PLOT OF V1*GS1 SYMBOL USED IS #

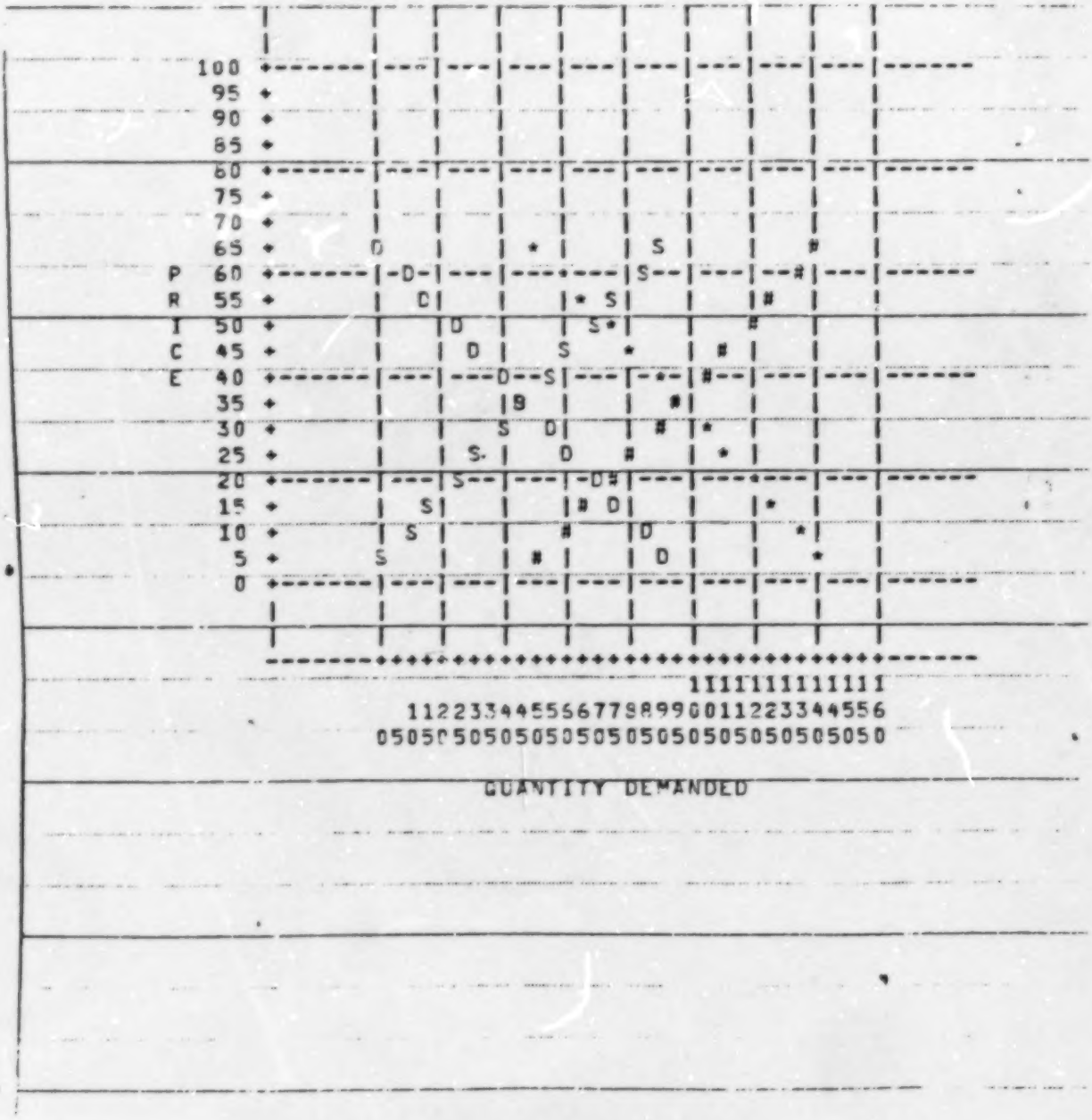
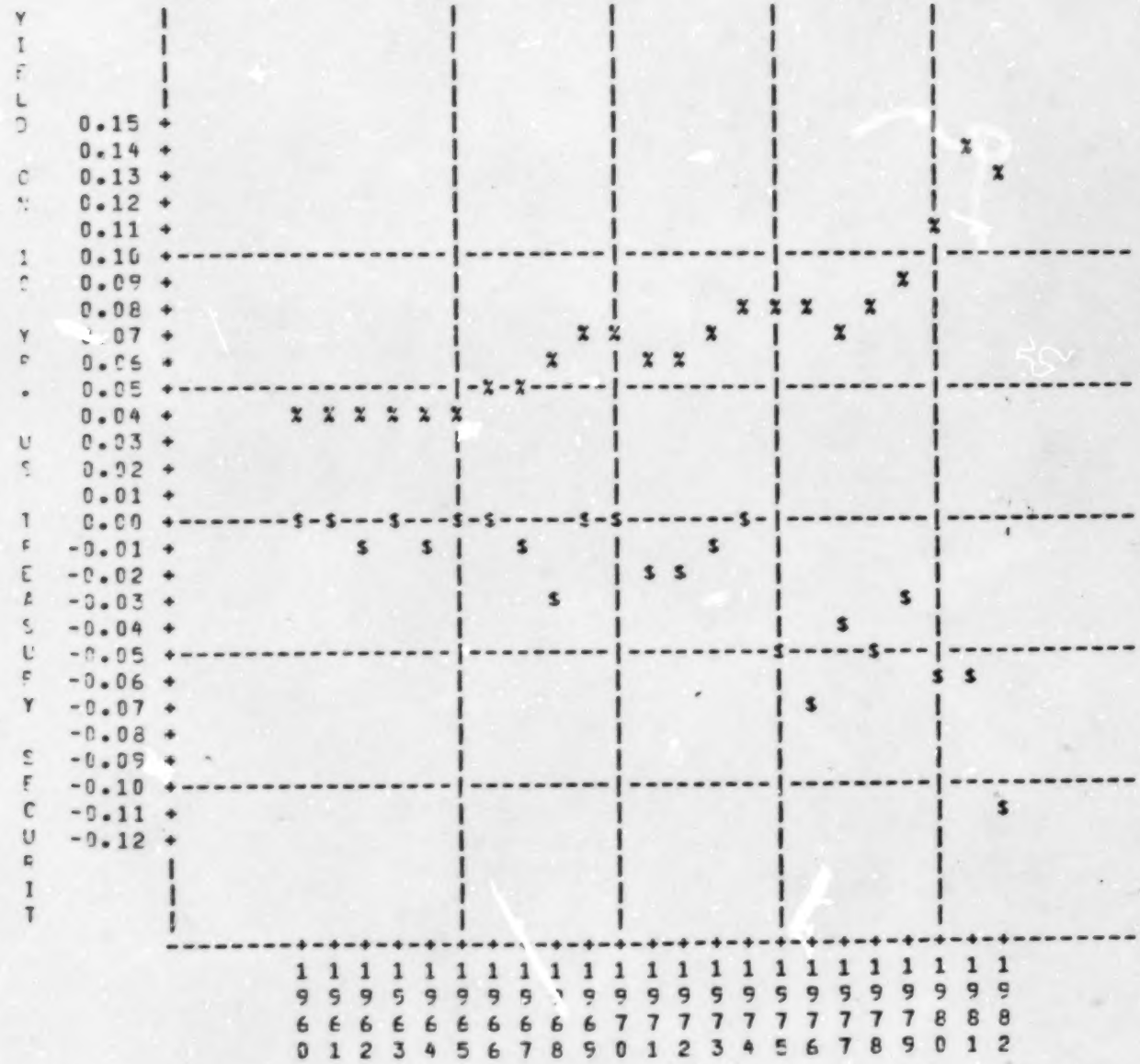


FIGURE NUMBER FOUR 22:25 SUND

PLOT OF 10 Yr. TREAS. YIELDS AND BUDGET DEFICITS OVER TIME
TREASURY YIELDS are expressed in decimal form as symbol %
FEDERAL BUDGET DEFICITS are expressed in trillions as symbol $

PLOT OF V3*V1 SYMBOL USED IS %
PLOT OF V2*V1 SYMBOL USED IS $



Windfall

User plays role of Chief Executive of Engulf Oil and attempts to turn crisis into cash. Huge gains (or losses) accrue from user's manipulation of prices, wages foreign suppliers, stock sales and collusions with the competition. Screen displays show results of manipulations both graphically and numerically as the helpless public lines up at the gas stations. (Edu-Ware Services)

Systems: Apple, Applesoft, 32K, cassette or diskette $14.95/$19.95

Suppliers: Edu-Ware; K-12 Micro Media; The Micro Center

Stock Market Game

Up to 4 players invest in stocks and bonds. News flashes, market trends, and stock splits affect the outcome. Game allows buying on the margin. (Acorn Software Products)

Systems: TRS-80, 16K, cassette $9.95

Merdet

This simulation, which takes about ten minutes to play, illustrates the difficulties of managing a simple economy. Students have an opportunity to allocate resources in order to meet pre-stated party goals. They will be purged if they fail to meet the goals, or if 50% of the people starve, or if the foreign exchange volume falls below $20,000. (Redcomp Services)

Systems: TRS-80, 16K, cassette or disk $23.50/$28.50

Suppliers: K-12 Micro Media

Market

(Part of Social and Economic Simulations)

Two people compete with each other in the bicycle manufacturing business. Each has to deal with the production, advertising, and pricing of his products and try to make money more quickly than his competitor. (Creative Computing Software)

Systems: Apple, 48K, diskette
Pet, 16K, cassette
TRS-80, 16K, cassette; 32K, disk

Management Decisions

Simulation of a business which manufacturers vulcanized pajamas, while competing with one other firm. The program provides financial projections for up to five years and makes decisions about the size of the sales force, advertising, credit terms, pricing, inventory, plant capacity, and manufacturing costs. The player must make decisions based on data such as balance sheets and earning statements which are supplied by the accounting department. Unforeseen circumstances will occur.

Systems: TRS-80, cassette or disk

$49.95/$57.95

Limits

(Part of Social and Economic Simulations, Creative Computing Software)

Based on the limits to growth study of the Club of Rome, this program is a world model with five major variables: population, pollution, food supply, industrial output, and resource usage. These are linked by the birth rate, death rate, population generation rate, resource usage rate, industrial growth rate, and food production rate. Varying these can result in insights into the possible future of the world. (Creative Computing Software)

Systems: Apple, 48K, diskette
Pet, 16K, cassette
TRS-80, 16K, cassette; 32K, diskette

Energy

(Part of Social Studies, Vol. 1, Minnesota Educational Computing Consortium)

Developed at N.W. Regional Lab to deal with the issue of energy supplies.

Systems: Apple, Applesoft, 32K, disk

Energy Czar

User assumes role of the government official in charge of making complex decisions on which energy sources to use; whether to tax or subsidize energy producers, tighten pollution controls, freeze prices, or ration gas. User also monitors the country's entire energy use system, including prices, taxes and environmental effects. Results of the decisions show up in the growth rate of the economy, the inflation rate, and public opinion.

Systems: Atari, 16K, cassette $14.95

Suppliers: Opportunities for Learning

Economy Simulation

(Part of Educational Package I, Micro Learningware)

Systems: TRS-80, 16K, cassette or disk $14.95

The Decades Game

One to four players learn historical data as they determine the dates of events in America's politics, economics, technology, science and art. There are three series of five different games in each series. The last program in each series is a test on the material preceding it. The computer records and scores the responses. The computer tallies the test, reports and comments on the grade, and suggests which lessons should be restudied. Information Booklet and Teacher's Guide. (Brain Box)

Systems: Apple, Applesoft 48K, cassette or disk $50.00 each series
Pet, 16K, cassette or disk $50.00 each series

Suppliers: Brain Bank (formerly Brain Box); K-12 Micro Media; The Micro Center

ADDITIONAL REFERENCES

COMPUTERS IN ECONOMICS

Anderson, Thomas H., Anderson, Richard C., Dalgaard, Bruce R., Wietecha, Edward J., Biddle, Barry, Paden, Donald W., Smock, H. Richard, Alessi, Stephen M., Surber, John R., Klemt, Laura L. "A Computer Based Study Management System", Educational Psychologist, 11(1974), 36-45.

Calkins, Ralph N. "A Computerized Model of Exchange as an Aid to Teaching Price Theory", The Journal of Economic Review, 1:2, Spring 1970, 97-103.

Chizmar, John F., Hiebert L., and McCarney B. "Assessing the Impact of an Instructional Innovation on Achievement Differentials: The Case of Computer Assisted Instruction", The Journal of Economic Education, 9:1, Fall 1977, 42-46.

Cox, Steven R. "Computer-Assisted Instruction and Student Performance in Macroeconomic Principles", The Journal of Economic Review 6:1, Fall 1974, 29-37.

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Dudley, D.A., Elledge, B. and Mukherjee, T. "The Effectiveness of Computer-Assisted Instruction in Economics: Some additional Evidence", Unpublished Manuscript, Appalachian State University, 1974.

Emery, E. David and Enger, T. "Computer Gaming and Learning in an Introductory Economics Course," The Journal of Economic Review, 3:2, Spring, 1972, 77-85.

Henry, Mark and Ramsett, D. "The Effects of Computer-aided Instruction on Learning and Attitudes in Economic Principles Courses." The Journal of Economic Education. 10:1, Fall 1978, 26-34.

Kelley, Allen C. "An Experiment with TIPS: A Computer-aided Instructional System for Undergraduate Education." American Economic Review, May 1968, pp. 446-457.

Marlin, James W. and Niss, J. "The Advanced Learning System: A computer-managed, Self-paced System of Instruction: An Application in Principles of Economics," The Journal of Economic Education, 13:2, Summer 1982, 26-39.

Soper, J.C. "Computer-Assisted Instruction in Economics," The Journal of Economic Education, Fall, 1974, 5-25.

Change Agent

A simulation game designed to teach the basic function of a change agent and to facilitate students' understanding of the theory of innovation diffusion and its application to developing societies. (Conduit)

Systems: TRS-80, 32K, disk $35.00

Suppliers: Conduit

Educational Package I

Includes a cell simulation, economy simulation, survival of the fittest simulation, projectile motion, and textbook reading difficulty analysis. (Micro Learningware)

Systems: TRS-80, 16K, cassette or disk $14.95

Suppliers: Micro Learningware

Educational Package I

Includes a cell simulation, economy simulation, survival of the fittest simulation, projectile motion, and textbook reading difficulty analysis. (Micro Learningware)

Systems: TRS-80, 16K, cassette or disk $14.95

Suppliers: Micro Learningware

U.S. Energy, Environment, and Economic Problems

This simulation can provide study of the formation of public policy through the interaction of the economy, energy supply and demand, and the physical environment. The model of public policy used includes societal, group and individual values and goals; governmental structures and processes; and the existing environment. Student adjust these components to explore their relationships and implications for real or foreseeable environmental issues.

Systems: TRS-80, 32K, disk $64.95

Suppliers: Opportunities for Learning

NOTE: This list came from a paper developed by Dr. James Hodges, Virginia Commonwealth University.

Treyz, George I., "The Use of Computers in Economic Education: Comment," The Journal of Economic Education, 2:2, Spring 1971, 175-176.

Vrooman, David H. "The Use of Computers in Economic Education: A Further Comment," The Journal of Economic Education, 5:2, Spring 1974, 135-137.